ASD-TR-68-45

AD 680011

SIMPLIFIED METHODS FOR COMMUNICATING INFORMATION

GARY B. McINTIRE, CAPTAIN, USAF

TECHNICAL REPORT ASD-TR-68-45

OCTOBER 1968

This document has been approved for public
release and sale; its distribution is unlimited.

D D C
JAN 7, 1969
C

DEPUTY FOR ENGINEERING
AERONAUTICAL SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

39

NOTICE

ABSTRACT

The objective of the study was to find improved ways to present technical information. This report briefly discusses and gives examples of how information may be presented more effectively by the use of Decision Logic Tables, Graphic/Text Combinations, Checklists, and Matrices. These methods are applicable to handbooks, technical reports, and operating guides.

ASD-TR 65-45

SIMPLIFIED METHODS FOR COMMUNICATING INFORMATION

GARY B. McINTIRE, CAPTAIN, USAF

ASD-TR-68-45

FOREWORD

This report is the result of a study on how to improve the presentation of information. The study was conducted from 1 January 1968 to 1 July 1968. The work was documented as part of Program 921A, Project 9072, Task 907201. Captain Gary B. McIntire of the Design Handbook Branch, Directorate of Engineering Standards, Deputy for Engineering, Aeronautical Systems Division, was in charge of the study. Valuable contributions of the following individuals are acknowledged:

Mrs. Adlyn K. Chappell for assistance in preparing examples and the final manuscript

Lt. Harvey C. Dorney for assistance in preparing examples.

This report was submitted by the author 1 August 1968.

Publication of this report does not constitute Air Force approval of the report's findings or conclusions. It is published only for the exchange and stimulation of ideas.

Charles E. Gustafson
CHARLES E. GUSTAFSON
Chief, Design Handbooks Branch
Standards Division

TABLE OF CONTENTS

SECTION PAGE

SECTION I

INTRODUCTION

This report shows four ways to improve the presentation of information. These are:

1. Decision Logic and "Talking" Tables
2. Graphic/Text Combinations
3. Checklists
4. Matrices

The majority of the report gives examples of how these methods have been or could be applied to actual cases. Brief comments on preparation and construction techniques are included.

SECTION II

DECISION LOGIC TABLE TECHNIQUES

The Decision Logic Table (DLT) technique is a method for arranging narrative information into a tabular format. The technique, or variations of it, can be profitably applied to many different types of information. A description of the DLT technique and methods for applying it to administrative information is contained in Air Force Pamphlet 5-1-1.

In general, a DLT is constructed as follows:

<table>
<tr><td colspan="4">TABLE NAME</td></tr>
<tr><td colspan="4">TABLE LOGIC</td></tr>
<tr><td>LINE OR RULE NO.</td><td>CONDITIONS (IF) (AND)</td><td>ACTIONS (THEN)</td><td>REMARKS WHICH APPLY TO THE LINE OR RULE NO.</td></tr>
<tr><td colspan="4">NOTES WHICH APPLY TO ITEMS IN THE TABLE.</td></tr>
</table>

For example, consider the information in the following paragraph.

> 7.1.1 TIME TO OPERATE
>
> "In any aircraft in which the flaps are operated by power, keep the normal time of operation in flight at maximum permissible flap operating speed of the aircraft within the following limitations. Ensure that the rate of lowering the flaps is not greater than 10 degrees per second. Accomplish complete lowering of the flaps, however, in a time not greater than 10 + (40/n) seconds where n is the design limit load factor of the aircraft. Ensure that time of operation specified applies at all ambient air temperatures between -20°F (-29°C) and +120°F (+49°C). Outside this range of temperature, but between -65°F (-54°C) and +160°F (+72°C), ensure that the time of operation is not more than 50 percent greater than the normal speed selected with all components of the flap actuating mechanism stabilized at the specified extreme temperature, and without assuming time for warmup of the components. Raise the flaps at such a rate that the resultant loss of lift coefficient can be compensated for by the increase in speed resulting from the application of full military power as in a go-around so that there is no loss in altitude. Never design the flaps to rise in less than 10 sec. In any aircraft in which flap operation can be accomplished by hand only, the times of operation in flight at maximum permissible flap operating speed of the aircraft are the same as those required above for power operation. Ensure that flaps are operable by emergency means within time limits specified for normal means, except when the emergency means are manually powered. In such cases, ensure that the operator's required effort does not exceed 25 lb force for more than 60 sec. Design the manual means so that they do not entail operation which is inconvenient or impractical to the operator."

By converting this paragraph into decision logic, we have the following table.

TEXT CONVERTED TO D

IN-FLIGHT FLAP OPERATING TIME R

IF			THEN			
			AT THE MAXIMUM PERMISSIBLE AIRCRAFT FLA			
			EXTEND THE FLAPS			
RULE	THE PRIMARY FLAP SYSTEM IS	THE EMERGENCY FLAP SYSTEM IS	WITHIN A TEMPERATURE RANGE OF	IN A TOTAL TIME	AT A RATE	WITHIN A R
1	POWER OPERATED		CENTIGRADE -29 to +49	Not greater than $(10 + \frac{40}{n})$ sec.	Not greater than 10 sec.	
			-54 to -29 +49 to +72	Not greater than $(15 + \frac{60}{n})$ sec ①		
2	MANUALLY OPERATED		Same as Rule 1			
3		POWER OPERATED	Same as Rule 1			
4		MANUALLY OPERATED		60 sec ②		

NOTES

① All components of the flap actuating mechanism must be stabilized at the specified test temperature. No component warm up time will be assumed.

② The method of operation must be convenient and practical.

TEXT CONVERTED TO DLT

IN-FLIGHT FLAP OPERATING TIME REQUIREMENTS						
THEN						REMARKS
THE MAXIMUM PERMISSIBLE AIRCRAFT FLAP OPERATING SPEED						
END THE FLAPS			RETRACT THE FLAPS			
TURE	IN A TOTAL TIME	AT A RATE	WITHIN A TEMPERATURE RANGE OF	IN A TOTAL TIME OF	AT A RATE	
	Not greater than (10 + $\frac{40}{n}$) sec.	Not greater than 10°/sec.		Not less than 10 sec.	Which ensures that aircraft speed will increase to compensate for the decrease in lift coefficient	n is the design load factor of the aircraft.
+72	Not greater than (15 $\frac{40}{n}$) sec. ①					
Same as Rule 1			Same as Rule 1			
Same as Rule 1			Same as Rule 1			
	60 sec. ②			10–60 sec. ②		Operator's force not to exceed 25 lb.
abilized at the specified test temperature.						

The DLT technique improves the presentation but not the quality of the information. In the example, the flap retract temperature range and the manual emergency system requirements need to be clarified. One of the major advantages of the DLT technique is that it will disclose discontinuities, discrepancies, or gaps in the information.

The application of "logic" to narrative or existing tables can be accomplished in many ways. The DLT construction rules may and should be modified to fit the information being presented. The following examples show applications of the DLT technique to various types of information.

EXAMPLE 1

A DLT WHICH PRESENTS CRITERIA FOR THE SELECTION OF CRANK DIMENSIONS

SELECTION OF CRANK DIMENSIONS					
RULE	If the crank load is (lb)	and if the turning rate is (rpm)	then the turning radius should be (inch)	and the handle length should be (inch)	and the handle diameter should be (inch)
1	less than 5	below 100	1-1/2 to 5	1-1/2 to 3	1/2 to 5/8
		above 100	1/2 to 4-1/2	1 to 1-1/2	3/8 to 1/2
2	more than 5	below 100	7-1/2 to 20	3-3/4 or larger	1 to 3
		above 100	5 to 9	3 to 3-3/4	not less than 1

EXAMPLE 2

THE FOLLOWING TABLE WAS INTENDED FOR USE AS AN OPERATOR'S GUIDE

TURBULENCE REPORTING CRITERIA TABLE

INTENSITY	AIRCRAFT REACTION	REACTION INSIDE AIRCRAFT	REPORTING TERM-DEFINITION
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as **Light Turbulence**;* or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as **Light Chop**.	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional – Less than 1/3 of the time. Intermittent – 1/3 to 2/3. Continuous – More than 2/3.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as **Moderate Turbulence**.* or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as **Moderate Chop**.	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	**NOTE** 1. Pilots should report location(s), time (GMT), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable. EXAMPLES: a. Over Omaha. 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707. b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as **Severe Turbulence**.*	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as **Extreme Turbulence**.*		

* High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

By converting this table into decision logic, we have the following table.

AIRCRAFT TURBULENCE REPORTING CRITERIA

LINE	IF THE TURBULENCE CAUSES THE AIRCRAFT TO EXPERIENCE	AND THE REACTION INSIDE THE AIRCRAFT IS	THEN REPORT THE TURBULENCE AS (see Notes 1 and 3)	IN THIS FORMAT
1	Momentary, slight, and erratic changes in altitude and or attitude (pitch, roll, yaw)	1. Occupants feel a slight strain against seat belts or shoulder straps 2. Unsecured objects displace slightly 3. Food service and walking can be conducted with little or no difficulty	OCCASIONAL INTERMITTENT → LIGHT TURBULENCE CONTINUOUS	1. Location 2. Time (GMT) 3. Intensity 4. Whether in or near clouds 5. Altitude 6. Type of aircraft 7. Duration (when applicable)--See Note 2. EXAMPLES a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707 b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8
2	Slight, rapid, and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude		OCCASIONAL INTERMITTENT → LIGHT CHOP CONTINUOUS	
3	Changes in altitude and or attitude similar to those in Line 1, but are of greater intensity (Aircraft remains in positive control at all times, but usually varies in indicated airspeed)	1. Occupants feel definite strains against seat belts or shoulder straps 2. Unsecured objects are dislodged 3. Food service and walking are difficult	OCCASIONAL INTERMITTENT → MODERATE TURBULENCE CONTINUOUS	
4	Rapid bumps or jolts without appreciable changes in aircraft altitude or attitude (Similar to those in Line 2, but are of greater intensity)		OCCASIONAL INTERMITTENT → MODERATE CHOP CONTINUOUS	
5	1. Large, abrupt changes in aircraft attitude and or attitude 2. Large variations in airspeed 3. Possibly momentary loss of control	1. Occupants are forced violently against seat belts or shoulder straps 2. Unsecured objects are tossed about 3. Food service and walking are impossible	OCCASIONAL INTERMITTENT → SEVERE TURBULENCE CONTINUOUS	
6	1. Violent tossing about 2. Practically impossible to control 3. Possible structural damage		OCCASIONAL INTERMITTENT → EXTREME TURBULENCE CONTINUOUS	

NOTES.

1. Definitions

Occasional — less than 1/3 of the time
Intermittent — 1/3 to 2/3 of the time
Continuous — more than 2/3 of the time

2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable (see Example b).

3. High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.

EXAMPLE 3

A DECISION LOGIC TABLE WHICH PRESENTS PROPELLANT SYSTEM DESIGN DATA

OXIDIZER SYSTEMS						
ITEM	IF THE OXIDIZER IS	THEN THE PREFERRED				REMARKS
		METALS ARE	NONMETALS ARE	THREAD SEALANTS ARE	LUBRICANTS ARE	
1	Fluorine	Stainless steel types 304, 321, 347; magnesium, bronze, brass, aluminum, and aluminum alloys 2017, 2024, 5052, 6061, 1100; nickel, tin, copper, pure silver, and Monel (best)	Teflon, Kel-F, Genetron plastics, or neoprene	Permatex No.3, Teflon tape, Kel-F No. 90, Fluorolube (white lead or litharge may be used on last threads only)	Teflon grease, Kel-F grease, Fluorolube, Molykote. or Q-Seal	a. All surfaces must be free of grease, oil, paints, dirt, dye, or combustible matter. b. Butt-weld pipe and fitting joints. Backup welding is desirable. c. Heliarc weld all components with inert gas backup. d. Do not use material containing silicone. e. Clean and passivate all surfaces contacting fluorine.
2	Liquid Oxygen	Copper, bronze; annealed brass, copper silicon alloy, Inconel, Monel, pure aluminum, 300 series stainless steel, copper	Teflon, pure asbestos, or Viton A	Teflon film, litharge and water (MIL-T-5542, AR-1F)	Chlorocarbon polymers, perfluorocarbon, Kel-F grease, or Halocarbon oils and greases	a. All surfaces must be free of grease, oil, paint, dirt, dye, organic, or combustible matter.
3	Perchloryl Fluoride	Carbon steel, pure aluminum, stainless steel, copper, brass, bronze	Teflon or Kel-F	Fluorolube is preferred, white lead (limited use)	Fluorolube	a. Heliarc weld tanks, pipes, and fittings. b. Passivate surfaces contacting perchloryl fluoride.

EXAMPLE 4

A "TALKING TABLE," A CROSS BETWEEN A DLT AND A REGULAR TABLE, CAN BE USEFUL IN PRESENTING COMPLEX DEFINITIONS

TERMS DEFINING AIRCRAFT CONTACT WITH THE WATER

THE TERM	IS DEFINED AS	AND MAY BE FURTHER CLASSIFIED AS	
Ditching	The landing of any aircraft upon the water with the intention of abandoning it. The aircraft may be of any type, including seaplanes, if the common elements of emergency and intention to abandon it are present. To conform to this definition, the aircraft must be at some speed above stall and the altitude must be under control at the instant of contact with the water. (This implies the pilot is able to select, at least to a limited degree, the point of touchdown.)	Planned	–when sufficient time is available to accomplish all recommended emergency procedures.
		Unplanned	–when little or no time is available to accomplish recommended emergency procedures.
		Attempted	–when control of the aircraft is lost after the decision to ditch but prior to contact with the water. The end result of an attempted ditching is, of course, a water-crash.
		Successful or Unsuccessful	
Water-Crash	When an aircraft is out of control at the time of contact with the water or flies into the water unintentionally.	Survivable or Unsurvivable	
Water-Overrun	When an aircraft fails to achieve flight or stop within the confines of the runway and comes to rest in the water.	Survivable or Unsurvivable	

EXAMPLE 5

EMERGENCY OPERATING PROCEDURES PRESENTED IN A DECISION LOGIC TABLE FORMAT

EMERGENCY PROCEDURES - STEAM PRESSURE DROPPING

LINE	IF	AND			DO THIS
	STEAM PRESSURE IS	A UTILITY TIE	THE GENERATORS ARE	THE RATE OF DROP IS	
1	Dropping	Exists	Carrying Plant No. 1	Slow	1. Build up steam pressure 2. Synchronize Bus #1 with Bus #2
2				Rapid	1. Initiate power failure procedures 2. Dump 3000-kw and 5000-kw generators 3. Energize Plant No. 1 Feeder to Bus #2 4. Build up steam pressure
3		Does not exist	Carrying the load for all plants	Slow	1. Synchronize Bus #2 with utility tie 2. Build up steam pressure
4				Rapid	1. Trip station service breaker if 5000-kw generator is on the line 2. Initiate power failure procedures 3. Dump 3000-kw and 5000-kw generators 4. Energize utility breaker 5. Build up steam pressure

EXAMPLE 6

A "TALKING TABLE" WHICH PRESENTS INFORMATION ON RELAY/BREAKER RELATIONSHIPS

	SWITCHGEAR RELAY OPERATION													
	THESE BREAKERS ARE TRIPPED									BY THESE RELAYS				
ON PANEL* NUMBER	POWER [illegible] INCOMING	PLOW FEEDER	STATION SERVICE	PLANTER FEEDER	PLANTER TIE	PLOW TIE	3000-KW GENERATOR	5000-KW GENERATOR	2000-AMP SECONDARY 480-VOLT	TYPE	DESIGNATION	INSTANTANEOUS ATTACHMENT	OPERATES AUX RELAY	REMARKS
1	X									Overcurrent	51(2)	X		Senses reverse or leading kilovars
	X									Directional Overcurrent	67(3)			
	X									Overcurrent to Ground	51N(1)			
2		X				X				Overcurrent	51(2)	X	X	
		X				X				Overcurrent to Ground	51N(1)	X	X	
3			X						X	Overcurrent	51(2)	X	X	
			X						X	Overcurrent to Ground	51N(1)	X	X	
	X		X						X	Ground Detection	95(1)		X	Senses ground in primary of transformer
	X		X							Under-frequency	81(1)		X	Senses station service frequency if 500-kw generator is on
4				X	X					Overcurrent	51(2)	X	X	
			X	X	X					Overcurrent to Ground	51N(1)	X	X	
	X		X							Undervoltage	27(1)		X	Senses Bus #2 voltage if 500-kw generator is on
5							X			Overcurrent	51V(3)			Voltage restrained
							X			Antimotoring	67N(1)			Protects from low steam flow
										Differential	87(3)		X	
							X			Lock-Out	86(1)			Protects generator internally
										Field Ground	64(1)			Sounds alarm with ground on field circuit
6								X		Overcurrent	51V(3)			Voltage restrained
								X		Antimotoring	67N(1)			Protects from low steam flow
										Differential	87(3)		X	Protects generator internally
								X		Lock-Out	86(1)			Protects generator internally
										Field Ground	64(1)			Sounds alarm with ground on field circuit

* All panels are located at the Master Control Console, Plant 1

SECTION III

GRAPHIC/TEXT COMBINATIONS

Combining the "words with the pictures" (graphic/text combination) is an effective way to present certain types of information. Graphic/text combinations may be achieved by:

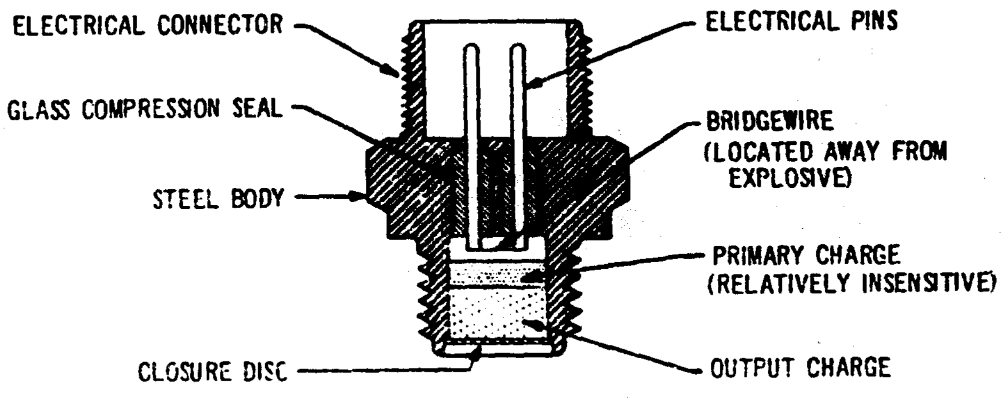
1. **Moving an illustration to where it is referenced in the text.**
2. **Combining the text material with the accompanying or referenced illustration.**
3. **Creating an illustration to combine with the text material.**

The following illustrations are examples of effective graphic/text combinations.

EXAMPLE 1

A GRAPHIC/TEXT COMBINATION WHICH DISCUSSES AND ILLUSTRATES THE CONSTRUCTION OF AN EXPLODING BRIDGEWIRE ELECTRO-EXPLOSIVE DEVICE

EXPLODING BRIDGEWIRE EED

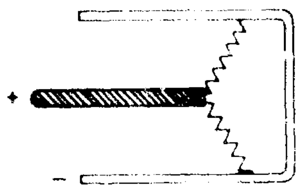


THIS TYPE OF ELECTRO-EXPLOSIVE DEVICE (EED) USES A FINE HIGH-RESISTANCE BRIDGEWIRE NEAR, BUT NOT IN CONTACT WITH, A CHARGE OF SOME SECONDARY EXPLOSIVE SUCH AS SENSITIZED PETN. WHEN EXTREME VOLTAGES ARE IMPRESSED ON THE BRIDGEWIRE, IT LITERALLY EXPLODES. THE SHOCK WAVE AND PARTICLES IMPINGE ON THE PRIMARY CHARGE AND CAUSE IT TO DETONATE.

EXAMPLE 2

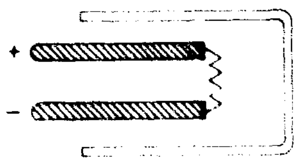
A GRAPHIC/TEXT COMBINATION WHICH DISCUSSES AND ILLUSTRATES DESIGN CONSIDERATIONS FOR BRIDGEWIRE CIRCUITS

COMMON BRIDGEWIRE CIRCUITS



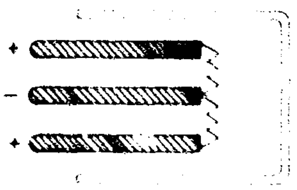
CIRCUIT A

CIRCUIT A OFFERS THE ADVANTAGE OF NOT BEING SUSCEPTIBLE TO ELECTROSTATIC DISCHARGE. THE CIRCUIT IS SIMPLE, REQUIRING ONLY ONE HOT LEAD AND USING THE CASE AS GROUND AND THE RETURN LEAD. DUAL BRIDGEWIRES ADD EXTRA RELIABILITY TO THE UNIT. THIS CIRCUIT IS SUSCEPTIBLE TO STRAY CURRENTS OR POTENTIALS THAT MAY OCCUR BETWEEN THE CASE OF THE UNIT, AND A DISTANT POWER SOURCE. THIS CIRCUIT DOES NOT PROVIDE FOR A CONTROLLABLE GROUND.



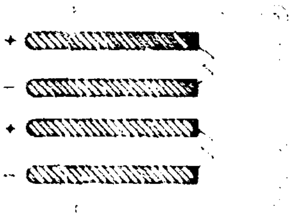
CIRCUIT B

CIRCUIT B OFFERS POSITIVE CONTROL OF THE UNIT BY HAVING BOTH A HOT AND A GROUND LEAD. HOWEVER, IT IS NOT AS RELIABLE AS UNITS HAVING DUAL BRIDGEWIRES; AND UNITS WITH THIS TYPE OF CIRCUITRY SHOULD BE USED IN PAIRS. THIS CIRCUIT IS SUSCEPTIBLE TO RF IGNITION AND ELECTROSTATIC DISCHARGE.



CIRCUIT C

CIRCUIT C OFFERS AN ADVANTAGE OVER CIRCUIT B IN THAT DUAL BRIDGEWIRES ARE PROVIDED. THE TWO HOT LEADS OFFER THE ADDED RELIABILITY OF BEING CAPABLE OF ROUTING FROM SEPARATE POWER SOURCES. HOWEVER, THE THREE LEADS REQUIRE MORE SPACE THAN A OR B. THE COMMON GROUND DECREASES THE RELIABILITY IN COMPARISON TO CIRCUIT D.



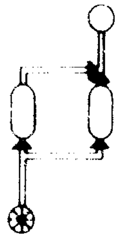
CIRCUIT D

CIRCUIT D HAS THE SAME POSITIVE CONTROL AS CIRCUIT B. THIS TYPE OF CIRCUIT OFFERS THE MAXIMUM IN RELIABILITY IN THAT THE HOT WIRES, AS WELL AS THE GROUND WIRES, CAN COME FROM SEPARATE SOURCES. THIS CIRCUIT, HOWEVER, REQUIRES MORE SPACE THAN EITHER A, B OR C, AND FOR THIS REASON MAY NOT BE INTEGRATED EASILY INTO SPACE-LIMITED INSTALLATIONS.

EXAMPLE 3

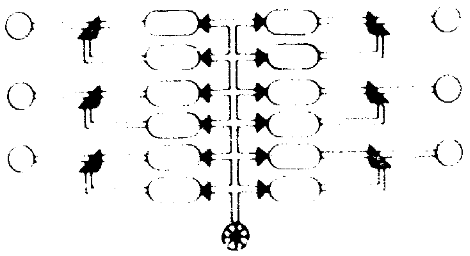
A GRAPHIC/TEXT COMBINATION WHICH DISCUSSES AND ILLUSTRATES DESIGN CONSIDERATIONS FOR GASEOUS OXYGEN SUPPLY SUBSYSTEMS

GASEOUS OXYGEN SUPPLY SUBSYSTEM



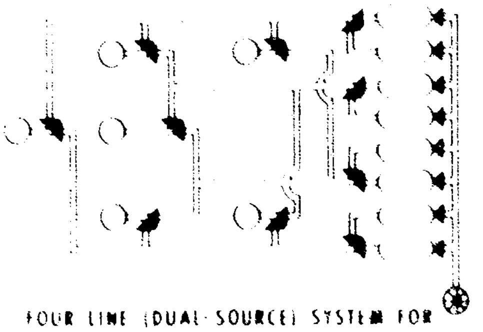
OXYGEN SYSTEM FOR SINGLE PLACE AIRCRAFT

SINGLE PLACE AIRCRAFT REQUIRE TWO OR MORE STORAGE CYLINDERS FOR PROTECTION AGAINST OXYGEN LOSS FROM GUNFIRE. SUBSYSTEM SAFETY DESIGN REQUIRES CHECK VALVES ON THE FILLER AND DISTRIBUTION MANIFOLDS. A FILLER VALVE AND THE FLIGHT STATION EQUIPMENT COMPLETE THE INSTALLATION.



INDIVIDUAL MANIFOLD SYSTEM FOR MULTIPLACE AIRCRAFT

A MULTIPLACE AIRCRAFT USING AN INDIVIDUAL MANIFOLD OXYGEN SUBSYSTEM PROVIDES A SINGLE INDEPENDENT MANIFOLD FOR EACH INDIVIDUAL STATION OUTLET. THE SAFETY DESIGN ADVANTAGE IS THAT NO SINGLE PUNCTURE OR RUPTURE WILL DEPRIVE MORE THAN ONE CREW MEMBER OF HIS OXYGEN SUPPLY. THE LENGTH OF CRITICALLY VULNERABLE TUBING IS REDUCED TO A MINIMUM. ALL OXYGEN CONTAINERS ARE CONNECTED TO A COMMON FILLER LINE SO THAT UNTIL THE CHECK VALVES ARE CLOSED BY PUNCTURE OR SUDDEN LOSS OF PRESSURE IN SOME PART OF THE SUBSYSTEMS, PRESSURES IN SOME OR ALL OF THE CONTAINERS (OXYGEN CYLINDERS) CAN BE KEPT EQUALIZED AT ALL TIMES.



FOUR LINE (DUAL SOURCE) SYSTEM FOR MULTIPLACE AIRCRAFT

IN MULTIPLACE AIRCRAFT USING A FOUR LINE (DUAL SOURCE) SUBSYSTEM, SEVERAL OUTLETS ARE CONNECTED TO A SINGLE MANIFOLD, BUT THE VARIOUS MANIFOLDS ARE SO INTERCONNECTED THAT EACH OUTLET IS ACTUALLY SUPPLIED FROM TWO MANIFOLDS. EITHER MANIFOLD MAY BE PUNCTURED WITHOUT DRAINING THE OTHER. THE ADVANTAGE OF THIS SUBSYSTEM IS THAT MANY OUTLETS CAN BE SUPPLIED BY RELATIVELY FEW CYLINDERS AND DISTRIBUTION LINES WITH MAXIMUM SAFETY. THIS TYPE OF SUBSYSTEM CAN BE MAINTAINED WITH LITTLE DIFFICULTY.

⊛ FILLER VALVE

○ FLIGHT STATION EQUIPMENT

▶ CHECK VALVE

⬭ CYLINDER

EXAMPLE 4

TEXT MATERIAL ON THE SEPARATION OF PRESSURE SOURCE COMBINED WITH AN ILLUSTRATION AND PLACED DIRECTLY UNDER THE TEXT REFERENCE

AFSC DH 1-6
DN 3G2

CHAP 3 - AEROSPACE VEHICLE SAFETY DESIGN
SECT 3G - PRESSURIZATION AND PNEUMATIC SYSTEMS

12.5 INCOMPATIBLE SYSTEMS

It is difficult to place incompatible systems within limited areas without an increase in hazard level. In this case, it is necessary to design these systems so that it is impossible to interconnect and mix incompatible commodities.

12.5.1 Separation of Pressure Source

For separation of pressure source see SN 12.5.1(1).

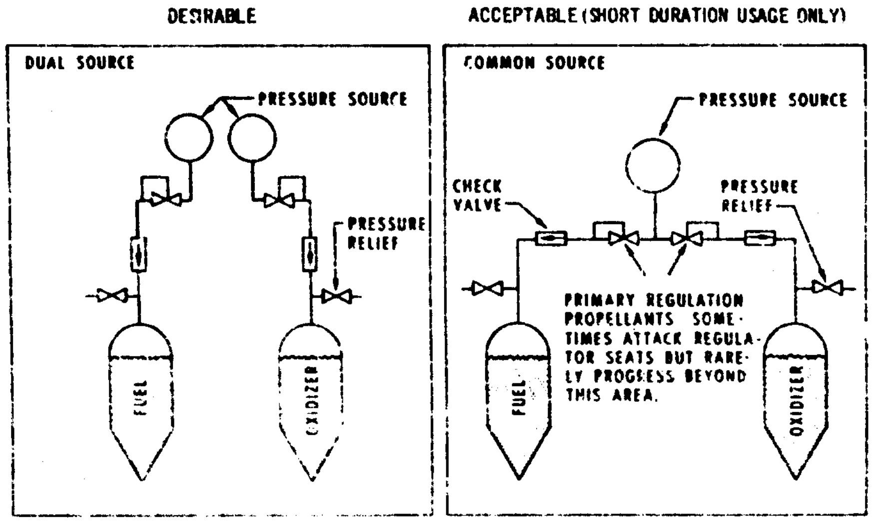
12.5.2 Connectors

Design and arrange connectors so that it is physically impossible to inadvertently connect adjacent pressure systems of one hazard level into a system of another level.

12. SAFETY FACTORS

The safety factor of a pressure system is the ratio of system operating pressure to the design burst pressure. This safety factor can range from 1.5:1 where remote

SUB-NOTE 12.5.1(1) Separation of Pressure Source

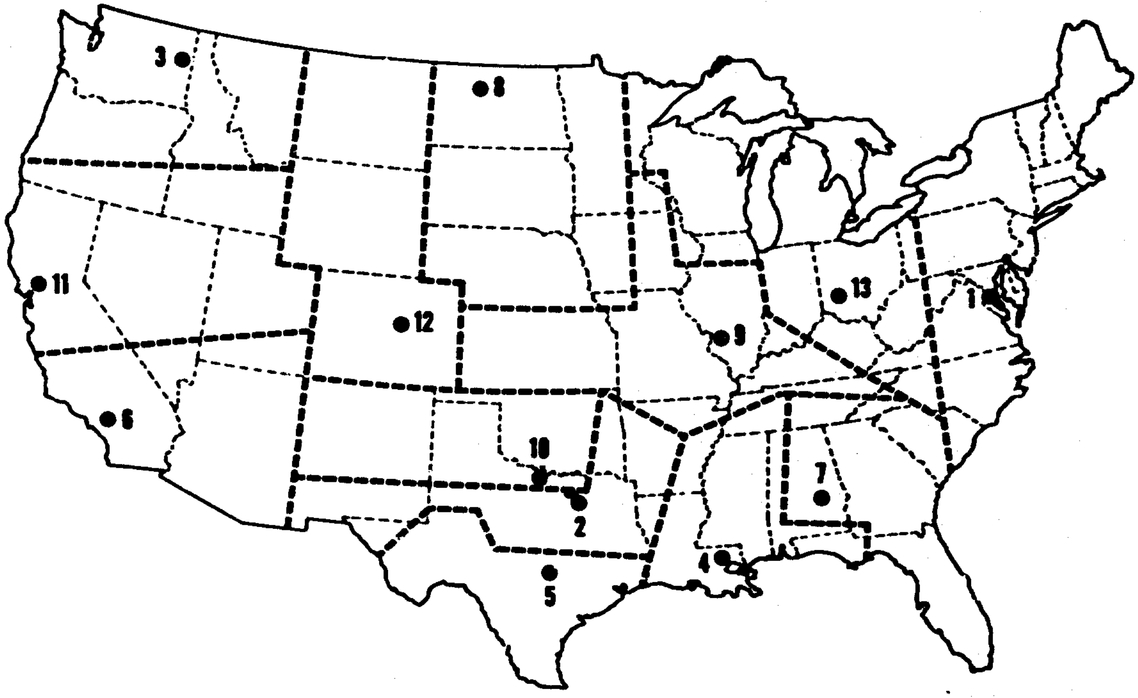


UNDER SOME CONDITIONS IT IS POSSIBLE FOR VOLATILE PROPELLANT FUEL AND OXIDIZER VAPORS TO MIGRATE BACK INTO THE PRESSURE SYSTEM. CHECK VALVES HAVE PROVED INEFFECTIVE IN PREVENTING THIS MIGRATION AS IT APPARENTLY OCCURS UNDER FLOW CONDITIONS WHEN THE CHECK VALVE IS OPEN. FOR THIS REASON, DO NOT PRESSURIZE INCOMPATIBLE HAZARDOUS FLUIDS FROM A COMMON SOURCE. SEPARATE SOURCES ARE REQUIRED IN ANY CASE, DOWNSTREAM OF THE PRIMARY REGULATION. WHEN A COMMON SOURCE IS USED PLACE IT AS FAR AS PRACTICABLE FROM THE PRIMARY REGULATION. COMMON SOURCE SYSTEMS ARE ACCEPTABLE FOR SHORT DURATION USE ONLY.

EXAMPLE 5

A GRAPHIC/TEXT COMBINATION SHOWING THE LOCATION OF U. S. AIR FORCE MEDICAL CENTERS. THE USE OF A MAP TO PORTRAY THE LOCATION OF MEDICAL CENTERS IS AN IMPROVEMENT OVER SIMPLY LISTING THEM.

U. S. AIR FORCE MEDICAL CENTERS



1. ANDREWS AIR FORCE BASE
CAMP SPRINGS,
MARYLAND 20331

2. CARSWELL AIR FORCE BASE
FORT WORTH,
TEXAS 76127

3. FAIRCHILD AIR FORCE BASE
SPOKANE,
WASHINGTON 99011

4. KEESLER AIR FORCE BASE
BILOXI,
MISSISSIPPI 39534

5. LACKLAND AIR FORCE BASE
SAN ANTONIO
TEXAS 78236

6. MARCH AIR FORCE BASE
RIVERSIDE,
CALIFORNIA 92508

7. MAXWELL AIR FORCE BASE
MONTGOMERY,
ALABAMA 36112

8. MINOT AIR FORCE BASE
MINOT,
NORTH DAKOTA 58701

9. SCOTT AIR FORCE BASE
BELLEVILLE,
ILLINOIS 62225

10. SHEPPARD AIR FORCE BASE
WICHITA FALLS,
TEXAS 76311

11. TRAVIS AIR FORCE BASE
FAIRFIELD,
CALIFORNIA 94535

12. UNITED STATES AIR FORCE ACADEMY
COLORADO SPRINGS,
COLORADO 80840

13. WRIGHT-PATTERSON AIR FORCE BASE
DAYTON
OHIO 45433

DIRECT ALL COMMUNICATIONS AND REQUESTS FOR SUPPORT AND ASSISTANCE TO THE CONSULTANT CENTER COMMANDER (FOR THE GEOGRAPHICAL AREA) AT THE INDICATED ADDRESSES

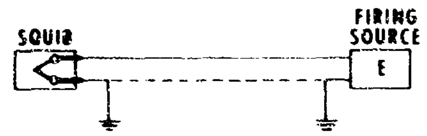
SEE AFR 160-51 FOR DETAILS ON SPECIFIC SERVICES AVAILABLE AND PROCEDURES OF UTILIZING SERVICES

EXPERT PATHOLOGISTS AND THE LABORATORY AREAS THEY REPRESENT ARE AVAILABLE AT THESE CENTERS FOR MEDICAL SUPPORT OF ACCIDENT INVESTIGATION. PRIMARILY THEY CAN PROVIDE EXPERT AUTOPSY SUPPORT.

EXAMPLE 6

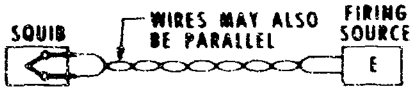
BASIC FIRING CIRCUIT DESIGN CONSIDERATIONS IN A GRAPHIC/TEXT COMBINATION

BASIC FIRING CIRCUITS



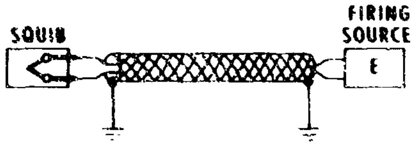
SINGLE CONDUCTOR WITH GROUND RETURN

A CIRCUIT IN WHICH A SINGLE, UNSHIELDED CONDUCTOR IS USED TO CONNECT THE SQUIB TO THE FIRING SOURCE, AND THE CASE OF THE WEAPON (ROCKET, MISSILE, OR BOMB) PROVIDES A GROUND RETURN. THIS CIRCUIT IS UNDESIRABLE SINCE IT HAS ALL THE CHARACTERISTICS OF A RECEIVING ANTENNA; ITS USE IS LIKELY TO RESULT IN THE FIRING OF THE SQUIB IN THE PRESENCE OF A PROPER RF FIELD.



TWISTED PAIR

AN IMPROVED CIRCUIT IN WHICH TWISTED-PAIR (OR TRANSPOSED-PAIR) OR PARALLEL-LEG WIRES ARE INSULATED WITH HIGH RF LOSS INSULATION, EXHIBITS TRANSMISSION LINE CHARACTERISTICS, AND IS LESS LIKELY TO RESPOND TO AN RF FIELD; THEREFORE, THERE IS LITTLE PROBABILITY THAT RF-INDUCED CURRENTS WILL FIRE THE SQUIB.



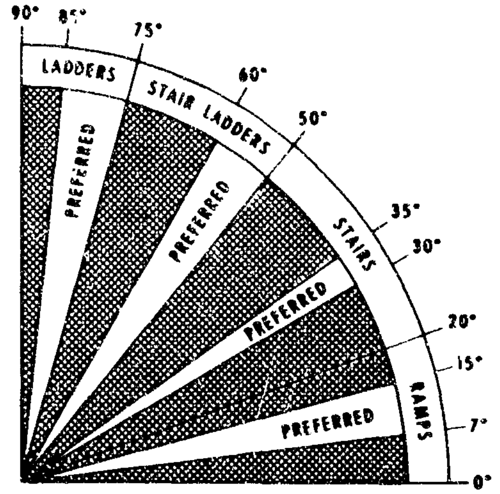
2 CONDUCTORS WITH BRAIDED SHIELD

IN THIS CIRCUIT ARRANGEMENT, THE FIRING CIRCUIT MAY BE EITHER TWISTED- OR PARALLEL-PAIR WIRES ENCLOSED WITHIN A SINGLE OR DOUBLE SHIELD OF COPPER BRAID. IN THE PRESENCE OF AN RF FIELD, THE INDUCED CURRENTS WILL FLOW ON THE SURFACE OF THE BRAIDED SHIELD AND WILL NOT AFFECT THE FIRING CIRCUIT. HOWEVER, TO BE MOST EFFECTIVE, THE SHIELDING OF THE SQUIB, FIRING CIRCUIT, SWITCH, AND FIRING POWER SOURCE MUST BE COMPLETE AND PROPERLY BONDED. THIS IS A PREFERRED CIRCUIT ARRANGEMENT.

EXAMPLE 7

MATERIAL CONTAINED IN TEXT CONVERTED TO TABULAR FORM AND COMBINED WITH AN ILLUSTRATION. THE PURPOSE WAS TO COMBINE, IN A SINGLE LOCATION, DESIGN INFORMATION FOR STAIRWAYS, LADDERS, AND RAMPS.

STAIRWAYS, LADDERS, AND RAMPS



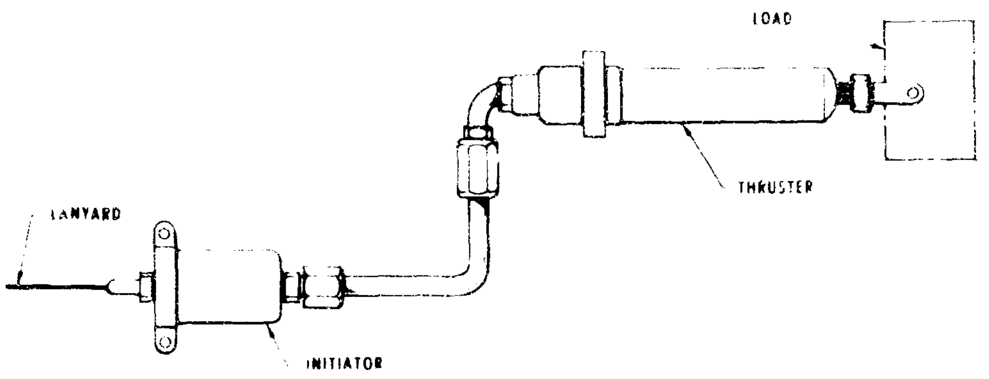
TYPE OF STRUCTURE IN RELATION TO ANGLE OF ASCENT

COMPONENTS	DIMENSIONS (INCHES)		
	MINIMUM	MAXIMUM	RECOMMENDED
STAIRS:			
Tread depth (including nosing)	9.50	12.00	11.00 - 12.00
Riser height	5.00	8.00	6.50 - 7.00
Depth of nosing (where applicable)	0.75	1.50	1.00
Width (handrail to handrail)			
One-way stairs	30.00	- -	36.00
Two-way stairs	48.00	- -	51.00
Overhead clearance	76.00	- -	78.00
Height of handrail (from leading edge of tread)	30.00	36.00	33.00
Width of handrail	1.25	3.00	1.50
Rail clearance from wall	1.75	- -	2.00
STAIR-LADDERS:			
Tread depth range			
For 50° rise	6.00	10.00	8.50
For 75° rise (open ladders only)	3.00	5.50	4.00
Riser height	7.00	12.00	8.90
Height, step to landing	6.00	12.00	8.90
Width (handrail to handrail)	21.00	24.00	22.00
Overhead clearance	68.00		76.00
Height of handrail (from leading edge of tread)	34.00	37.00	35.00
Width of handrail	1.25	2.00	1.40
Rail clearance from wall	2.00		3.00
FIXED LADDERS:			
Rung thickness			
Wood	1.13	1.50	1.40
Protected metal	0.75	1.50	1.40
Corrosive metal	1.00	1.50	1.40
Rung spacing	9.00	16.00	12.00
Height, rung to landing	6.00	16.00	12.00
Width between stringers	12.00		18.00 - 21.00
Climbing clearance width	24.00		30.00
Clearance depth			
In back of ladder	6.00		8.00
On climbing side (range)		36.00 for 72° to 30.00 for 90°	
Height of stringer above landing			36.00

EXAMPLE 8

A GRAPHIC/TEXT COMBINATION WHICH EXPLAINS THE OPERATION OF A PROPELLANT ACTUATED DEVICE

SIMPLIFIED PROPELLANT ACTUATED DEVICE (PAD)

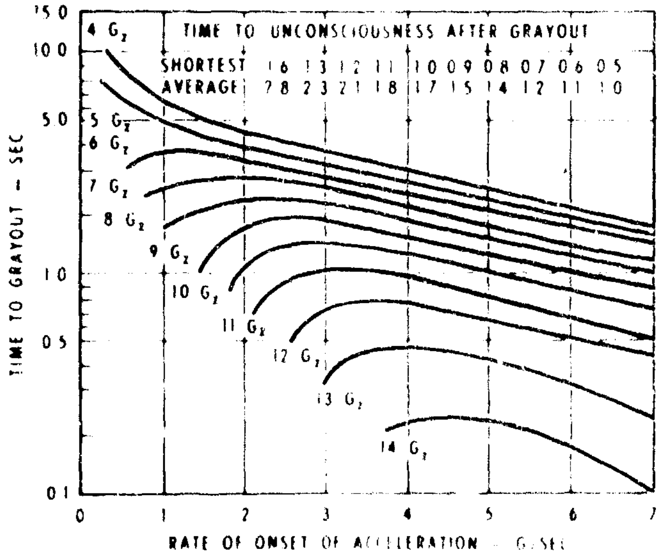


IN THIS SYSTEM, A MECHANICALLY OPERATED INITIATOR IS CONNECTED TO A THRUSTER BY A LENGTH OF HOSE. WHEN THE LANYARD IS PULLED, THE INITIATOR CARTRIDGE IS FIRED. THE BURNING PROPELLANT IN THE INITIATOR GENERATES GAS WHICH FLOWS THROUGH THE HOSE TO THE THRUSTER. WHEN SUFFICIENT GAS PRESSURE IS EXERTED ON THE THRUSTER FIRING MECHANISM, THE THRUSTER CARTRIDGE IS FIRED. AS THE PROPELLANT BURNS IN THE THRUSTER, THE PRESSURE IN THE THRUSTER CHAMBER INCREASES AND CAUSES THE THRUSTER PISTON TO EXTEND, MOVING A BODY (LOAD).

EXAMPLE 9

A GRAPHIC/TEXT COMBINATION WHICH PORTRAYS AND DISCUSSES THE EFFECTS OF ACCELERATION STRESS ON PHYSIOLOGY AND PERFORMANCE

ACCELERATION EFFECTS — RATE OF ONSET

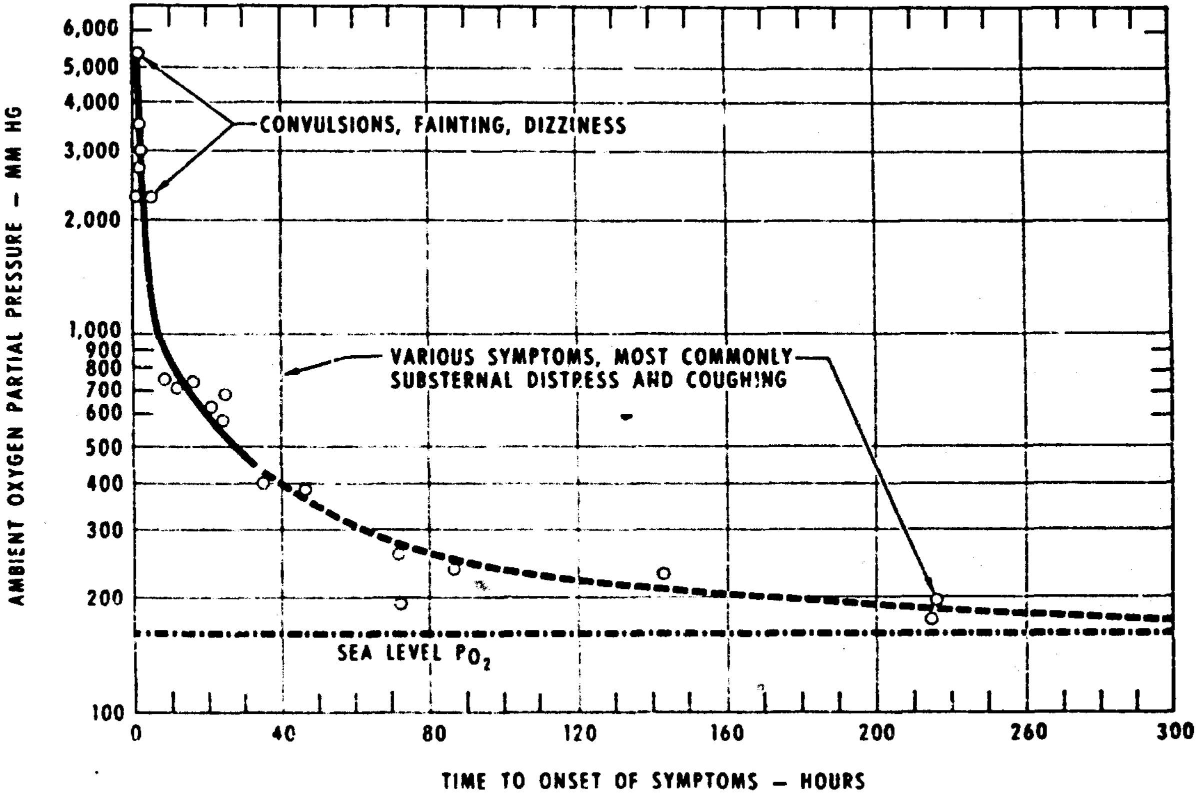


THIS GRAPH RELATES THE ONSET RATE OF ACCELERATION TO TIME TO END POINT. IT SHOWS THAT FOR ANY GIVEN POSITIVE ACCELERATION (G_z) FROM 4 TO 14 G, THE TIME TO GRAYOUT DEPENDS ON HOW RAPIDLY THE ACCELERATION LEVEL WAS REACHED. FURTHER, THE TABLE INSET IN THE GRAPH SHOWS THE SHORTEST TIMES AND THE AVERAGE TIMES FOR UNCONSCIOUSNESS TO DEVELOP FOLLOWING GRAYOUT, EACH PAIR OF VALUES BEING RELATED TO AN ONSET RATE. FOR EXAMPLE, AT ONSET RATE OF 4 G/SEC, THE SHORTEST TIME TO UNCONSCIOUSNESS WAS 1.1 SEC, AND THE AVERAGE 1.8 SEC.

EXAMPLE 10

A GRAPH ON OXYGEN TOXICITY COMBINED WITH A DISCUSSION OF THE PRESENTED INFORMATION

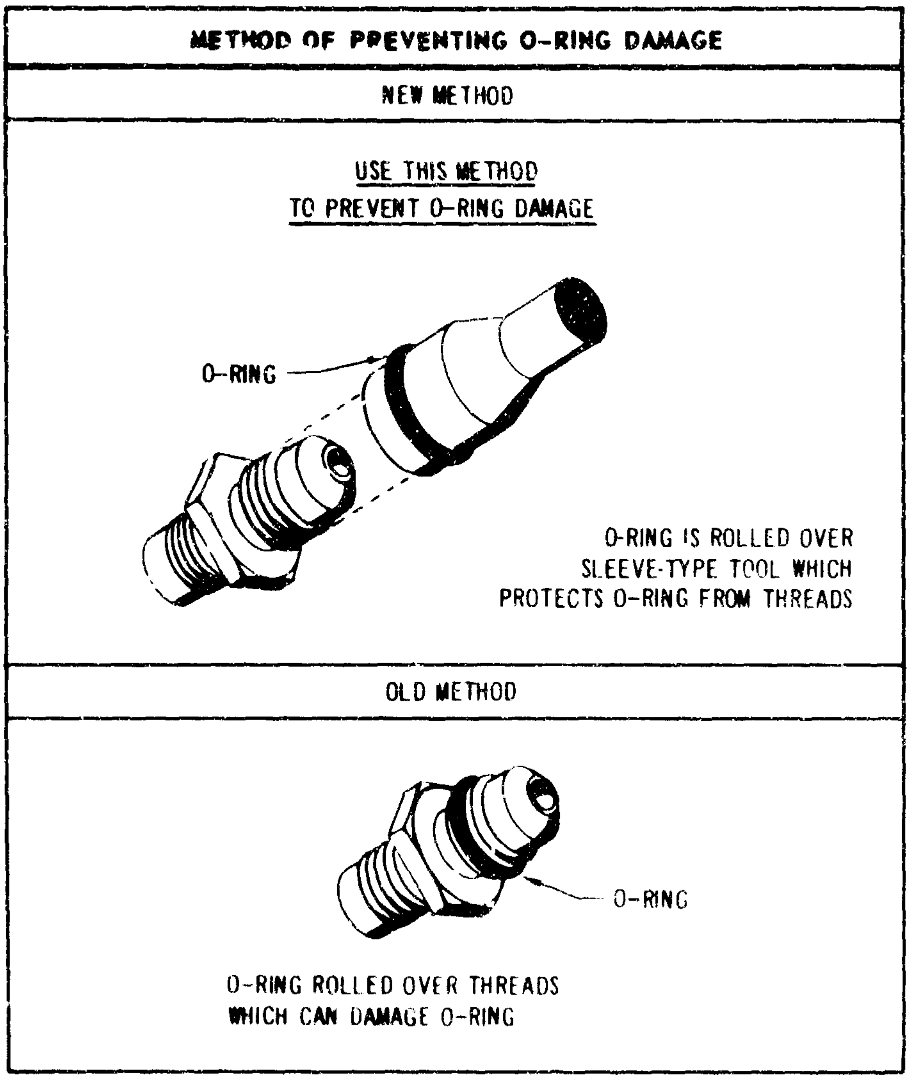
OXYGEN TOXICITY



THE CURVE REPRESENTS THE APPROXIMATE TIME OF APPEARANCE OF TOXIC SIGNS AND SYMPTOMS. THESE VARY WITH THE PARTIAL PRESSURES OF O_2 (P_{O_2}) WHICH CAUSE THEM. ABOVE 760 MM HG, THE CENTRAL NERVOUS SYSTEM IS THE PRIMARY SITE OF DEFECT WITH SYMPTOMS SUCH AS NAUSEA, DIZZINESS, CONVULSIONS, AND SYNCOPE. IN THE RANGE OF 400 TO 760 MM HG, RESPIRATORY AND NERVOUS SYSTEM SYMPTOMS PREDOMINATE. THESE ARE SUBSTERNAL DISTRESS (BRONCHITIS AND PROBABLY ATELECTASIS), PARESTHESIA, AND NAUSEA. IN THE RANGE OF 200-400 MM HG, REPORTED SYMPTOMS ARE RESPIRATORY AND POSSIBLY HEMATOLOGICAL AND RENAL: SUBSTERNAL DISTRESS, PROTEIN, AND CYLINDRICAL CASTS IN THE URINE. WHETHER OR NOT THERE IS REALLY "TOXICITY" IN THE LOW LEVEL, LONG TIME EXPOSURE IS BEING DEBATED. STUDIES IN PROGRESS MAY CLARIFY THE EXACT CAUSE OF SYMPTOMS AND LABORATORY FINDINGS IN THIS LOWER RANGE. THE ROLE OF CONTAMINATING GASES (N_2) AND TRACE VAPOR CONTAMINANTS IN THE OXYGEN IS STILL UNKNOWN.

EXAMPLE 11

A GRAPHIC/TEXT COMBINATION WHICH RECOMMENDS AN O-RING INSTALLATION METHOD



METHOD OF PREVENTING O-RING DAMAGE

NEW METHOD

USE THIS METHOD
TO PREVENT O-RING DAMAGE

O-RING IS ROLLED OVER
SLEEVE-TYPE TOOL WHICH
PROTECTS O-RING FROM THREADS

OLD METHOD

O-RING ROLLED OVER THREADS
WHICH CAN DAMAGE O-RING

SECTION IV

CHECKLISTS

Checklists help a reader to:

- Recognize the key points developed in the text.
- Effectively apply the information to a specific task.

Included in this Section are:

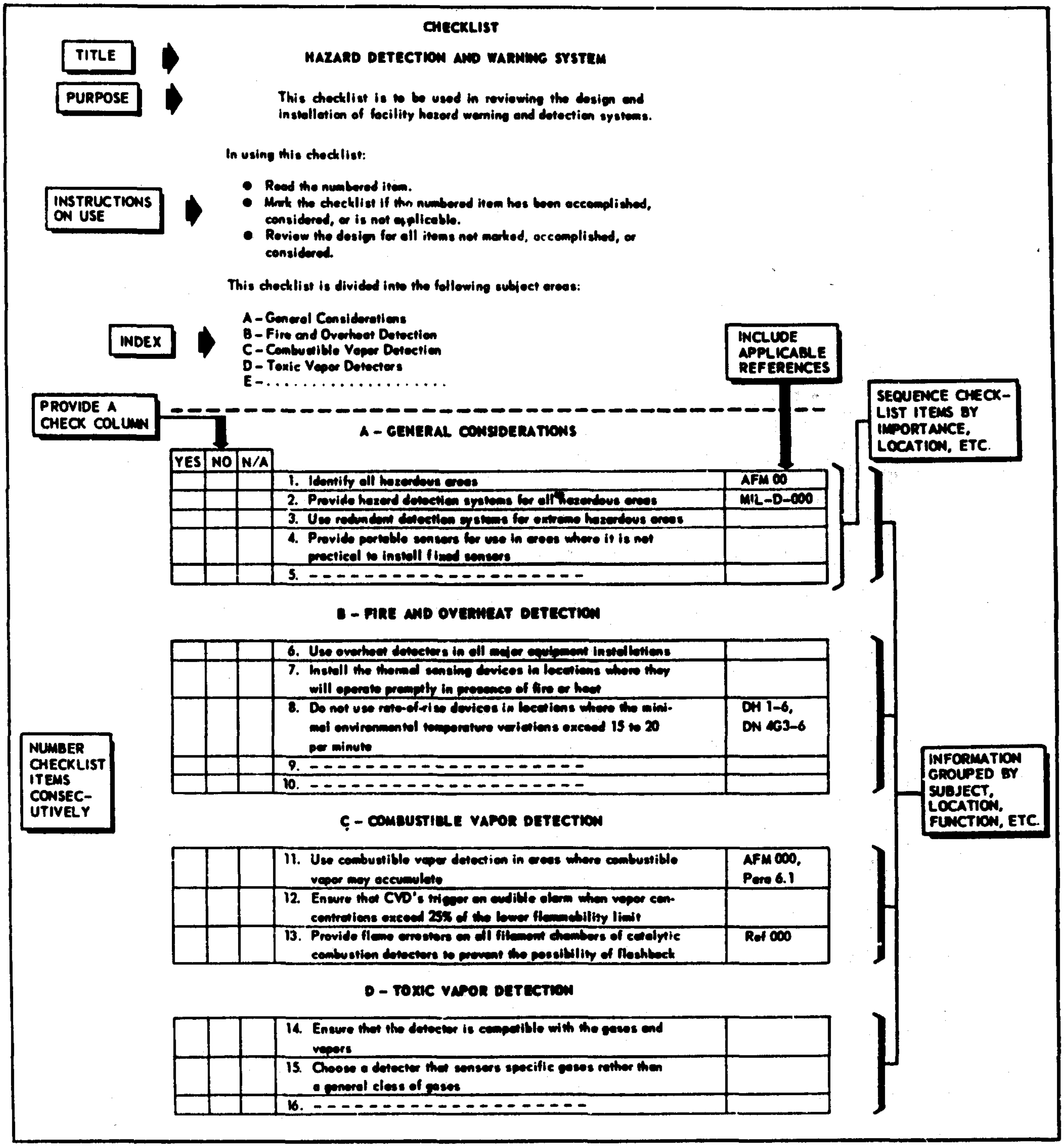
- Suggestions for preparing checklist material.
- A recommended checklist format.

SUGGESTIONS FOR PREPARING CHECKLIST MATERIAL

NO.	SUGGESTIONS	EXAMPLES		
1	Use simple, brief, direct language	Ensure that handholds are provided so that they are not less than 4 ft. or more than 4 ft. 8 in. above the step tread.	➡	1. Provide handholds between 4 ft. and 4 ft. 8 in. above the step tread. 2. Are handholds provided between 4 ft. and 4 ft. 8 in. above the step tread?
2	Choose a format which most effectively presents the information.	STATEMENTS QUESTIONS QUESTION AND ANSWER		● Design environmental systems to meet the requirements of MIL-E-0000. Comply with MIL-E-0000. ● Has the environmental system met all MIL-E-0000 requirements? ● What requirements must the environmental system meet? – Those contained in MIL-E-0000.
3	Each checklist item should contain only one point, consideration, instruction, etc.	Ensure that a positive latching device prevents inadvertent in-flight hook extension and that an arresting hook-down indicator is provided to the pilot.	➡	1. Provide a positive latching device which will prevent inadvertent in-flight hook extension. 2. Provide the pilot with an arresting hook-down indicator.
4	Arrange checklist items in a logical or natural sequence.	DECREASING IMPORTANCE 1. Emergency systems are completely independent of primary systems. 2. No possibility exists for interconnecting pressure and return systems. 3. Sharp corners are eliminated to reduce installation damage. 4. Ground test connectors are provided. 5.		GENERAL TO SPECIFIC 1. Conduct a complete fire hazard analysis whenever oxygen atmospheres are used. 2. Ensure that the ignition temperature of all materials is known when the oxygen content is more than 30%. 3. Ensure that the material flame propagation rate is less than 0.33 in./sec. in oxygen concentrations greater than 30%. 4. . . . .
5	Group related information.	CABLES AND CONNECTORS 1. Are cables routed so they cannot be pinched by doors, lids, etc.? 2. Are cables routed so that they are very unlikely to be walked on or used for handholds? 3. Are plugs provided which can be quickly disconnected? 4. Is each pin on each plug clearly identified? 5. Are cables routed so that they need not be bent and unbent sharply when they are connected or disconnected? 6. Are plugs designed so that it is impossible to insert any plug in the wrong receptacle? 7. Has provision been made for easy passage of cables with their attached connectors through walls, bulkheads, etc.? 8. Do aligning pins or keys extend beyond electrical pins?	➡ ➡	CABLES 1. Are cables routed so they cannot be pinched by doors, lids, etc.? 2. Are cables routed so that they are very unlikely to be walked on or used for handholds? 3. Are cables routed so that they need not be bent and unbent sharply when they are connected or disconnected? 4. Has provision been made for easy passage of cables with their attached connectors through walls, bulkheads, etc.? CONNECTORS 5. Are plugs provided which can be quickly disconnected? 6. Is each pin on each plug clearly identified? 7. Are plugs designed so that it is impossible to insert them in the wrong receptacle? 8. Do aligning pins or keys extend beyond electrical pins?

EXAMPLE 1

A RECOMMENDED CHECKLIST FORMAT



CHECKLIST

HAZARD DETECTION AND WARNING SYSTEM

This checklist is to be used in reviewing the design and installation of facility hazard warning and detection systems.

In using this checklist:

- Read the numbered item.
- Mark the checklist if the numbered item has been accomplished, considered, or is not applicable.
- Review the design for all items not marked, accomplished, or considered.

This checklist is divided into the following subject areas:

A – General Considerations
B – Fire and Overheat Detection
C – Combustible Vapor Detection
D – Toxic Vapor Detectors
E – . . . .

A – GENERAL CONSIDERATIONS

YES	NO	N/A		
			1. Identify all hazardous areas	AFM 00
			2. Provide hazard detection systems for all hazardous areas	MIL-D-000
			3. Use redundant detection systems for extreme hazardous areas	
			4. Provide portable sensors for use in areas where it is not practical to install fixed sensors	
			5. –	

B – FIRE AND OVERHEAT DETECTION

			6. Use overheat detectors in all major equipment installations	
			7. Install the thermal sensing devices in locations where they will operate promptly in presence of fire or heat	
			8. Do not use rate-of-rise devices in locations where the minimal environmental temperature variations exceed 15 to 20 per minute	DH 1-6, DN 4G3-6
			9. –	
			10. –	

C – COMBUSTIBLE VAPOR DETECTION

			11. Use combustible vapor detection in areas where combustible vapor may accumulate	AFM 000, Para 6.1
			12. Ensure that CVD's trigger an audible alarm when vapor concentrations exceed 25% of the lower flammability limit	
			13. Provide flame arrestors on all filament chambers of catalytic combustion detectors to prevent the possibility of flashback	Ref 000

D – TOXIC VAPOR DETECTION

			14. Ensure that the detector is compatible with the gases and vapors	
			15. Choose a detector that sensors specific gases rather than a general class of gases	
			16. –	

SECTION V

MATRICES

Rectangular arrays — matrices — are useful for showing relationships between groups or sets of information.

If:

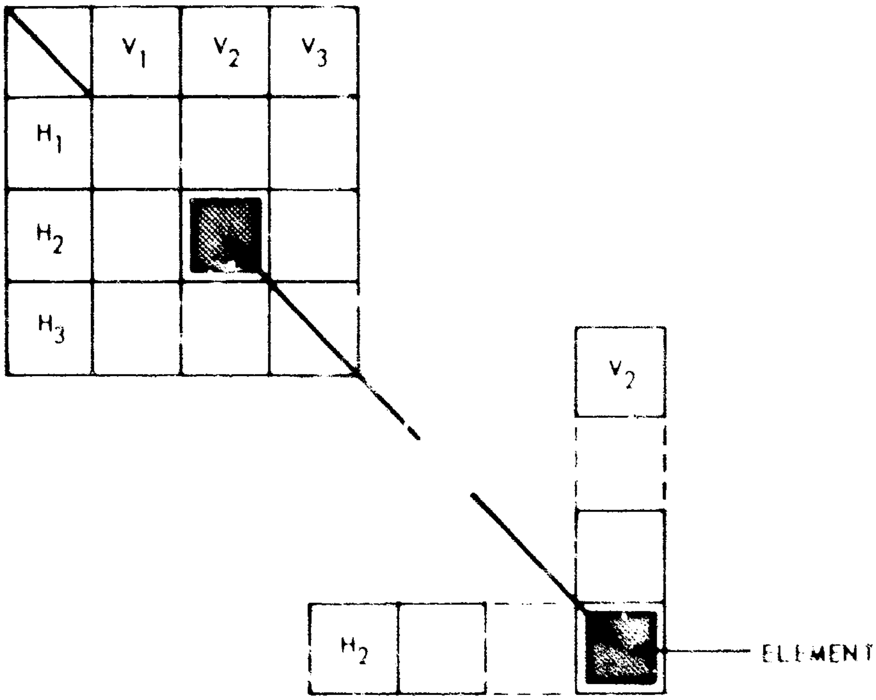
H represents the members of the horizontal information set

And:

V represents the members of a vertical information set

Then:

The resulting matrix is



Where:

The intersection of the H row and V column is called an element.

Information contained in an element may show:

- A direct relationship (H is related or not related to V)
- The result or nature of the relationship (H and V are compatible)

EXAMPLE 1

CONSTRUCTION OF AN INFORMATION MATRIX

IF a set of malfunctions:

H_1 — No power to unit

H_2 — No sweep

H_3 — Erratic sweep rotation

AND a set of corrective actions:

V_1 — Check AC power

V_2 — Replace fuse

V_3 — Reset circuit breakers

ARE arranged in a Matrix

		V_1	V_2	V_3
	CORRECTIVE ACTION MALFUNCTION	CHECK AC POWER	REPLACE FUSE	RESET CIRCUIT BREAKERS
H_1	No power to unit	■		
H_2	No sweep			
H_3	Erratic sweep		■ F-10	

THEN the matrix "information level" may be considered as the number of information items contained in the element.

AND

- The H_1V_1 element presents first level information (H_1 is related (positively) to V_1)
- The H_2V_2 element presents first level information (H_2 is related (negatively) to V_2)
- The H_3V_2 element presents "second level" information (H_3 is related to V_2 — the nature of the relationship is Fuse F-10)

To assist the user, all information matrices should have a visible grid.

EXAMPLE 2

A MATRIX TO ASSIST DESIGNERS IN SELECTING COMPATIBLE MATERIALS FOR FUEL/PROPELLANT SYSTEMS. INFORMATION NEEDED TO UNDERSTAND THE MATRIX (DEFINITIONS OF S, L, U, ETC.) IS LOCATED DIRECTLY UNDER IT.

SYSTEMS COMPATIBILITY

	METALS																				
SERVICE	Bronze	Aluminum	Carbon Steel	Carbon Moly Steel	3-1/2% Ni Steel	4-6% Chr Moly St	304 Stainless St	316 Stainless St	347 Stainless St	400 Series S S	Monel	Nickel	Copper	NONMETALS	Neoprene	Viton	Teflon	Kel-F	Zytel-Nylon	Asbestos	Buna-N
CRYOGENIC																					
Fluorine (Liquid)	S	S	U				S	S	S	L	S	S	S		U	U	U	U	U	U	U
Hydrogen (Liquid)	S	S	U				S	S	S	S	S	S	S		U	U	S	S	S	S	U
Nitrogen (Liquid)	S	S	U				S	S	S	S	S		S		U	U	S	S	U	S	U
Oxygen (Liquid)	S	S	U				S	S	S	S	S	S	S								
OXIDIZER																					
Chlorine Trichloride	S	S					S	S	L	S	S	S	S		U	U	S	S	U	U	U
Fluorine (Gas)	S	S	U				S	S	S	S	S	S	S		U	S	S	S	U	U	U
Hydrogen Peroxide		S					L	L	L			U	U			L	S	S	U		U
Nitric Acid (Fuming)	U	S	U	U	U	U	S	S	S	U	U	U	U		U	U	S	S	U	U	U
Nitrogen Tetroxide	U	L	L	U	U		S	S	S	L		L					S	S		S	
FUELS																					
Ammonia	U	L	L			L	S	S	S	S	S	L	U				S	S		S	
Gasoline	S	S	S	S	S	S	S	S	S	S	S	S	S								
Hydrazine	U	S	U				S_1	S_1	S_1	S		U				U	S	S		S	
UDMH	U	S	U				S_1	S_1	S_1	S	S	U				U	S	S			
Kerosene, JP-1, JP-4, JP-5, RP-1	U	S	S	S	S	S	S	S	S	S	S	S	U		S		S	S		S	S
Alcohol		S	S	S											S	L	S	S	U	S	L
Pentaborane	S	S	S								S	S				S		S			
OTHERS																					
Ethylene Oxide	U	S	S				S	S	S	S			U				S	S	S		S

S SATISFACTORY
U UNSATISFACTORY
L LIMITED USE
BLANK NO DATA AVAILABLE
S_1 AT BELOW BOILING POINT OF FLUID

EXAMPLE 3

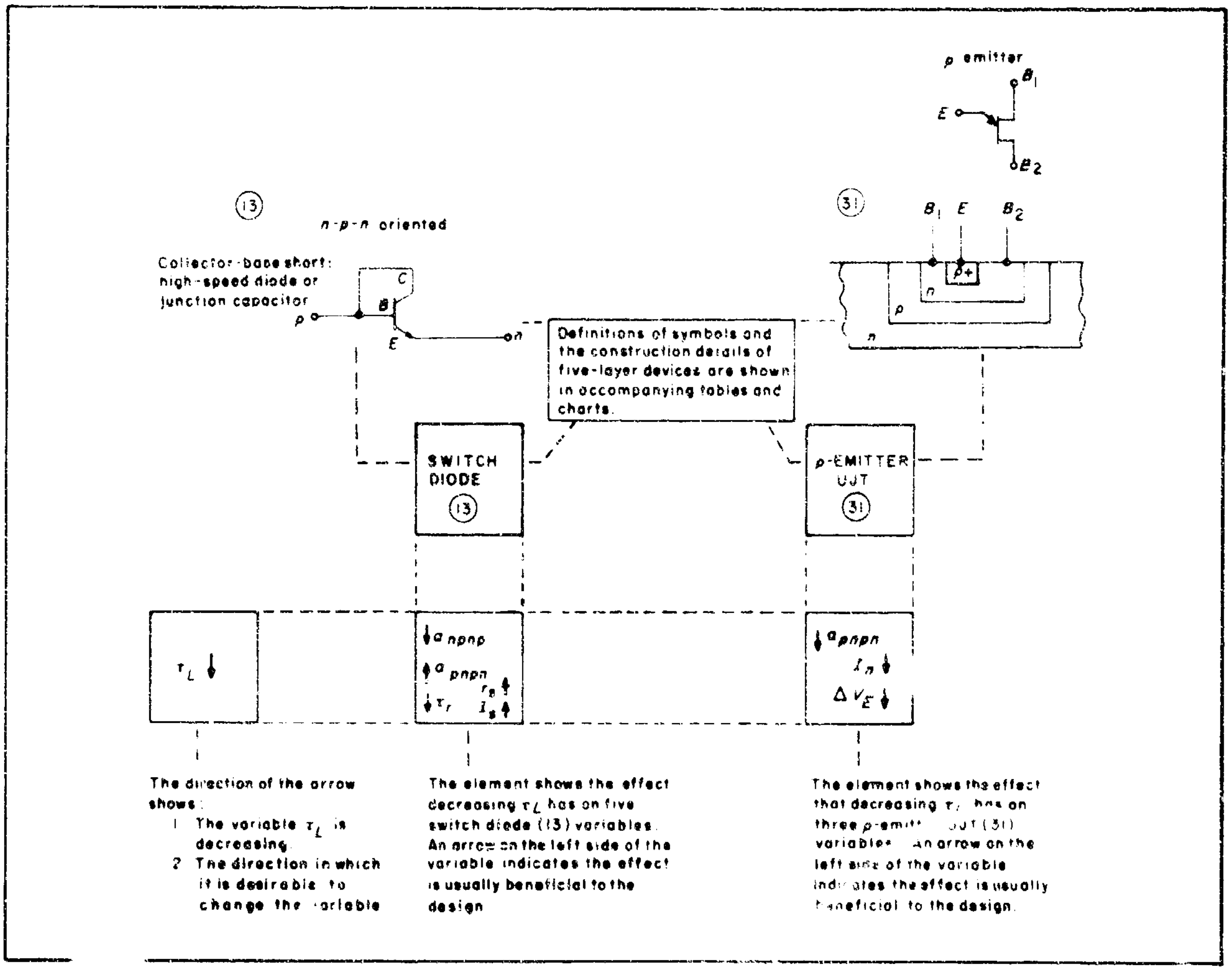
A COMPLEX MATRIX SHOWING THE EFFECT OF PHYSICAL VARIABLES ON INTEGRATED FIVE-LAYER DEVICES

[illegible]	1	2	Surface diode 13	Storage diode 15	3	4	Surface diode 14	Storage diode 16	Resistor 17	Resistor 18	Capacitor 19	Diode capacitor 20	Vertical SCR 29	Lateral SCR 30	UJT 31	UJT 32	FET 33	FET 36	MOST 37	MOST 38	MOST 39	MOST 40
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]			[illegible]		[illegible]	[illegible]								
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]		[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				
[illegible]												[illegible]							[illegible]	[illegible]	[illegible]	[illegible]

This table contributed by <u>ELECTRO-TECHNOLOGY</u>, Conover-Mast Publications, Inc., New York, N.Y. Compatibility in Monolithic Integrated Circuits, by Justin E. Harlow III and Harold C. Josephs.

AN ELEMENT BREAKOUT OF EXAMPLE 3

THE CONSTRUCTION OF A COMPLEX INFORMATION MATRIX USUALLY REQUIRES THE SUPPORT OF ACCOMPANYING TABLES, CHARTS, AND DIAGRAMS. THESE SUPPORTING ITEMS MUST BE PLACED NEAR THE MATRIX SO THAT A USER CAN QUICKLY REFER TO THEM.



Definitions of symbols and the construction details of five-layer devices are shown in accompanying tables and charts.

The direction of the arrow shows:

1. The variable τ_L is decreasing.
2. The direction in which it is desirable to change the variable

The element shows the effect decreasing τ_L has on five switch diode (13) variables. An arrow on the left side of the variable indicates the effect is usually beneficial to the design

The element shows the effect that decreasing τ_L has on three p-emitter UJT (31) variables. An arrow on the left side of the variable indicates the effect is usually beneficial to the design.

EXAMPLE 4

A MATRIX USED AS AN INDEX FOR TABLES CONTAINING DESIGN INFORMATION SOURCES

	SOURCES OF DESIGN INFORMATION																						
SYSTEMS	PARA REFERENCED IN TABLE 1												PARA REFERENCED IN TABLE 2										
	a	b	c	d	e	f	g	h	i	j	k	l	a	b	c	d	e	f	g	h	i	j	k
Airframe/Structures					●			●		●					●							●	
Landing, Alighting, and Arresting						●			●	●					●							●	
Propulsion		●				●			●	●			●	●	●				●	●		●	
Fuel/Propellant		●				●			●	●			●	●	●	●			●	●		●	●
Hydraulic		●				●				●			●	●	●				●	●		●	
Pressure and Pneumatics		●				●			●	●			●	●	●	●				●		●	
Electrical										●			●		●				●			●	
Mechanical					●			●		●					●							●	
Guidance/Flight Control					●					●					●							●	
Navigation					●		●			●					●		●	●			●	●	
Communication										●					●		●					●	
Protection						●				●					●							●	●
Fire Suppression		●				●			●	●					●		●					●	●
Crew Station	●									●					●							●	
Life Support	●									●					●	●	●					●	●
Escape, Survival, and Rescue	●									●					●		●					●	●
Crash/Survival	●								●	●					●		●					●	●
Ordnance/Armament			●	●		●				●	●	●	●	●	●					●		●	
Abort and Destruct			●	●		●				●	●	●	●	●	●					●		●	

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Deputy for Engineering
Aeronautical Systems Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP

3. REPORT TITLE
SIMPLIFIED METHODS FOR COMMUNICATING INFORMATION

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

5. AUTHOR(S) *(First name, middle initial, last name)*
Gary B. McIntire, Captain, USAF

6. REPORT DATE
October 1968

7a. TOTAL NO. OF PAGES
46

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.

b. PROJECT NO. 9072

c. Task No. 907201

d. Program 921A

9a. ORIGINATOR'S REPORT NUMBER(S)
ASD-TR-68-45

9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*

10. DISTRIBUTION STATEMENT
This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Deputy for Engineering
Aeronautical Systems Division
Wright-Patterson Air Force Base, Ohio

13. ABSTRACT

The objective of the study was to find improved ways to present technical information. This report briefly discusses and gives examples of how information may be presented more effectively by the use of Decision Logic Tables, Graphic/Text Combinations, Checklists, and Matrices. These methods are applicable to handbooks, technical reports, and operating guides.

DD FORM 1 NOV 65 1473

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Documentation						
Reports						
Handbooks						
Information Presentation						
Decision Logic						
Checklists						